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# Partial fix for global warming

## Scientists think adapting coal burning plants is key

By Nancy Mayer  
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LIVERMORE — While policy-makers haggle over an international agreement to reduce global warming, scientists are quietly toiling at Sandia National Laboratories to find technical fixes and solve outstanding mysteries.

Larry Baxter and Allen Robinson, who prepared some of the scientific reports being used by U.S. negotiators at a conference this week in Kyoto, Japan, think they have found a partial remedy.

By adapting coal-burning installations to use scrap wood, straw, nutshells and other material in addition to coal, the United States could cut the plants' emissions of carbon dioxide from 10 percent to 15 percent, Baxter and Robinson said.

The process is called "co-firing" because it combines both coal and biomass, or plant matter.

"It would be the thing we could start to do the soonest, but it's not going to solve the whole problem," said Baxter, principle investigator at Sandia's Internationally acclaimed Combustion Research Facility.

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Will Bolton

global climate researcher at Sandia Lab

Coal-burning plants produce 54 percent of the nation's energy. They are among the larger manmade sources of carbon dioxide and other "greenhouse gases," which scientists think may slowly cause our planet to become too hot for life as we know it.

Other sources are the burning of oil and natural gas.

Carbon dioxide — considered the main culprit in global warming — is exhaled by humans, is one of the primary raw materials that make plants grow, and is the gas that gives soda its fizz. Oceans and forests are good at absorbing it.

Scientists believe it and other gases — including methane and nitrous oxide — have built up in a way that traps the sun's energy, allowing too little to escape into space and pushing up

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Earth's average temperature.

If temperatures do rise 2 to 4 degrees near the end of the next century as some scientists have predicted, then coastal areas the world over could be flooded as the polar ice caps melt. Farmland could be turned into wasteland and vice versa.

Officials from 155 nations are gathering for 10 days through Wednesday to consider the problem.

Some say drastic regulatory measures are needed to overcome the lack of financial incentives for making adjustments.

Denmark, for instance, which gets 80 percent of its energy from coal, has declared a moratorium on the construction of new coal-burning plants and plans to phase out all existing plants by 2030.

While Denmark's position is more extreme than most, European nations generally favor more aggressive policies than those being considered by the United States. European leaders often cite a return to the emission levels of 1990 as an appropriate benchmark.

Some countries want cuts up to 15 percent deeper, while the Clinton administration doesn't support even the 1990 benchmark, saying it is not clear yet whether any action is needed.

The co-firing option, however, would let the United States achieve 1990 emission levels in the coal sector without radical changes in the way the plants operate, says Robinson, a mechanical engineer.

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# Scientists: Solution isn't justified yet

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Although he and Baxter recommend the shift, they do not support the more stringent measures proposed in Europe.

"I'm not sure we know it's justified yet," Baxter said, noting that scientific research on the problem began only five years ago, and that "a lot of the earlier projections were hugely exaggerated."

Will Bolton, another Sandia researcher, is developing technology that could help resolve uncertainty over the threat of global warming.

"There's general agreement that there's cause for concern, but the magnitude and time scales are not clear," said Bolton, who is studying how clouds interact with the solar energy that drives Earth's weather patterns.

Clouds — which both heat and cool the earth, depending on environmental conditions — are the largest single source of uncertainty in computer models that have been used to predict global warming, Bolton said.

When scientists run their various models with an assumption that skies are always clear, different models produce similar conclusions. With clouds in the picture, their answers differ widely, showing that current models will need to become more detailed if they are to make accurate predictions.

Bolton's group is leading a multi-agency effort to adapt a

military reconnaissance plane for scientific missions 65,000 feet above sea level, twice as high as the altitude of commercial airliners and high enough to soar atop clouds to gather needed data.

The slender, long-winged Altus 2 broke altitude records for aircraft of its kind by flying to 43,500 feet in September.

"Our goal is to improve the scientific understanding that makes for better policy," Bolton said.

Jay Keller, manager of Sandia's hydrogen energy research program, doesn't want to wait for better computer models to begin taking precautions against the possibility of catastrophic rises in carbon dioxide emissions.

"The fact that I don't know is enough for me to say let's stop," he says.

Keller, a mechanical engineer, manages a group developing more efficient car engines and entirely new types of vehicles he says may offer three times better mileage than today's cars in just years.

He opposes the emissions restrictions proposed in Europe, favoring energy taxes instead. The taxes would be highest for fuels with the highest carbon

content, like coal, and lowest for those with the least.

His tax plan would help drive the economy toward hydrogen-based engines and batteries, which would contain no carbon.

Hydrogen-based systems are a long-term option, he said, because they require "a new mindset and a new infrastructure," including locally available hydrogen refueling stations.

"But we have to start now in order to get that change in 50 years," Keller says.